User Guide for

FEBFDMQ8203_13 W GreenBridge™ Evaluation Kit for Power Over Ethernet 13 W Flyback DC-DC

MLP 4.5x5 GreenBridge™
SSOT-6 150 V MOSFET
SSOT-3 30 V MOSFET

Featured Fairchild Products:
FDMQ8203, FDC86244, FDN537N

Direct questions or comments about this evaluation board to: "Worldwide Direct Support"

Fairchild Semiconductor.com

© 2012 Fairchild Semiconductor Corporation

Table of Contents

1. Introduction 3
   1.1. Description 3
   1.2. Features 3
2. Evaluation Board Specifications 3
3. Photographs 4
4. Printed Circuit Board 5
5. Schematic 6
6. Bill of Materials 8
7. Electrical Characteristics 10
8. Setup and Test Procedure 11
   8.1. Hardware Connector Description 11
9. Performance of Evaluation Board 12
10. Revision History 13

The following user guide supports the evaluation kit for high-efficiency, IEEE802.3af, Class3 Power over Ethernet Power Device (PoE PD) Flyback DCDC with PoE interface controller. It should be used in conjunction with the FDMQ8203 datasheet as well as Fairchild's application notes and technical support team. Please visit Fairchild's website at www.fairchildsemi.com.

1. Introduction

This board is designed to rectify the positive and negative power source from Power Source Equipment (PSE) and regulate 48 V (36 V ~ 57 V) to provide 5 V_{OUT} at maximum 2.6 A with 250 kHz switching frequency and over 90% of the total efficiency in the compact power density. It meets the required specification under IEEE802.3af.

1.1. Description

This kit contains the MLP 4.5x5 GreenBridge™ MOSFET evaluation board.

1.2. Features

- GreenBridge™ FDMQ8203 quad P&N-Channel MOSFET
- Flyback Primary Switch FDC86244 Single N-Channel MOSFET
- Flyback Secondary Switch FDN537N Single N-Channel MOSFET
- Controller IEEE802.3at PD with Flyback Controller
- Output-Voltage Range 5 V, Adjustable by R39 and R37
- Switching Frequency 250 kHz, Adjustable by C55
- Maximum Output Current 2.6 A, Limited by Power Component

2. Evaluation Board Specifications

Table 1. MOSFET Parameters

Part Number	Location	Package	BV_{DSS} (V)	$R_{DS(ON)}$ [mΩ] at 10 V_{GS}	Qg [nC] at 10 V_{GS}	C_{OSS} [pF]
				Max.	Typ.	Typ.
FDMQ8203	Q1, Q4	MLP4.5x5	100	110	2.9	41.0
	Q2, Q3		-80	190	13	46
FDC86244	Single	SSOT-6	150	144.0	4.2	32.0
FDN537N	Single	SSOT-3	30	28	5.3	135

3. Photographs

Size = 70 X 60 mm.

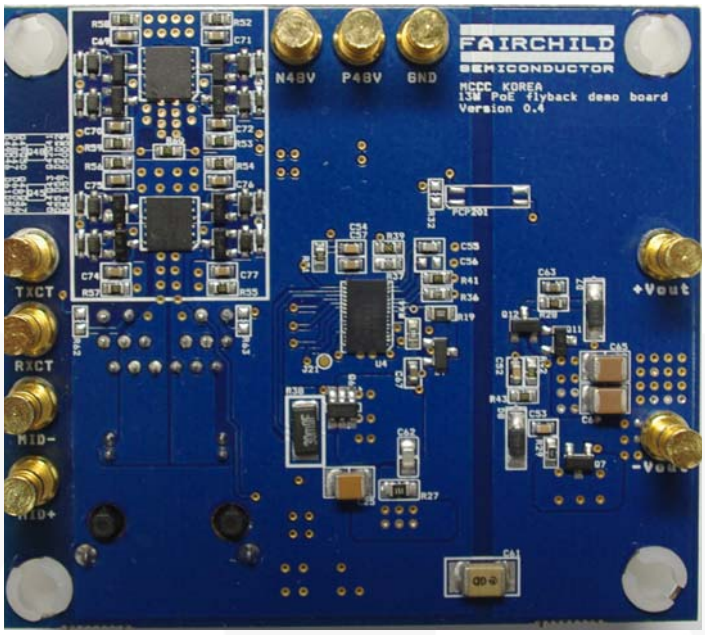

Figure 1. Top Side View of Evaluation Kit

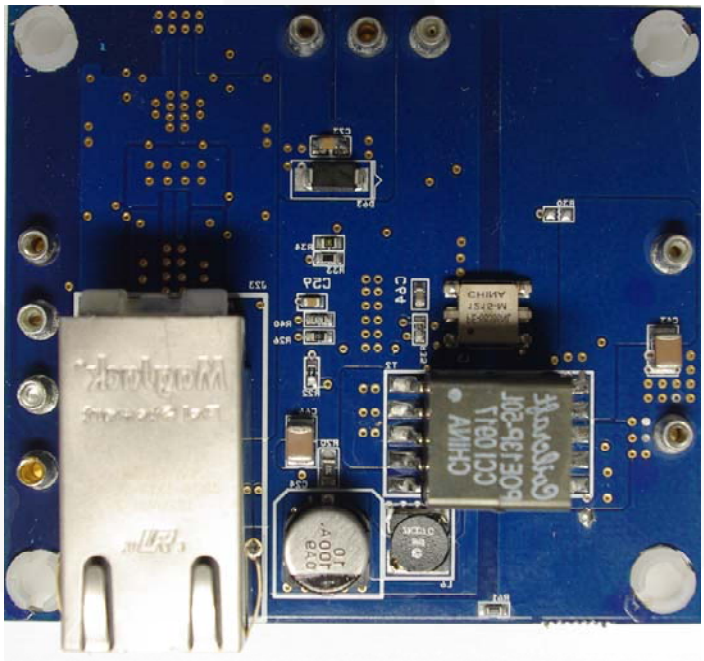

Figure 2. Bottom Side View of Evaluation Kit

4. Printed Circuit Board

PCB Layout (70 mm x 60 mm, 4-Layer).

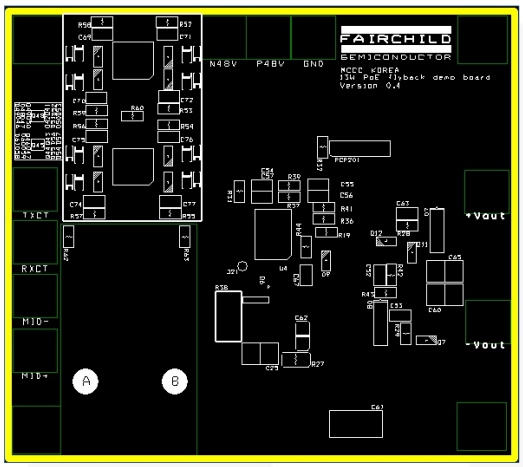

Figure 3. SST (Component Side) Layer

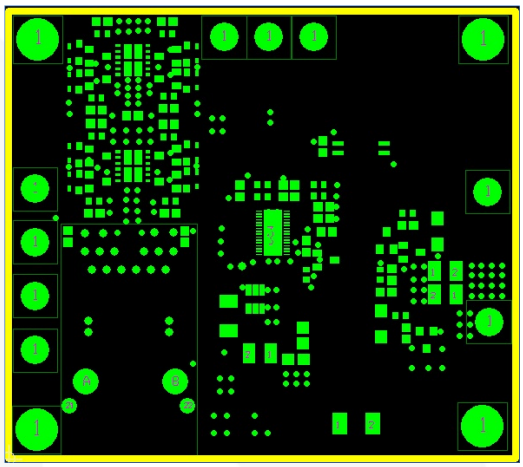

Figure 4. SSB (Component) Layer

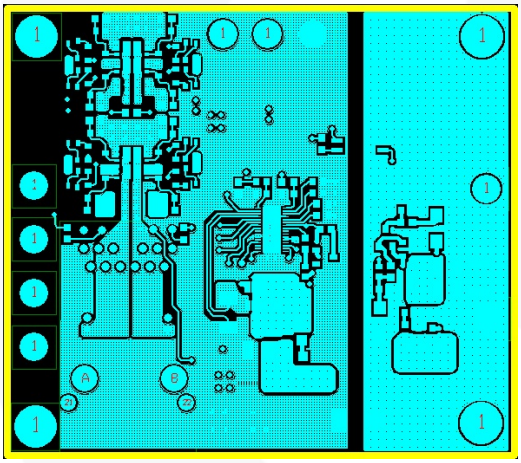

Figure 5. TOP & SMT Layer

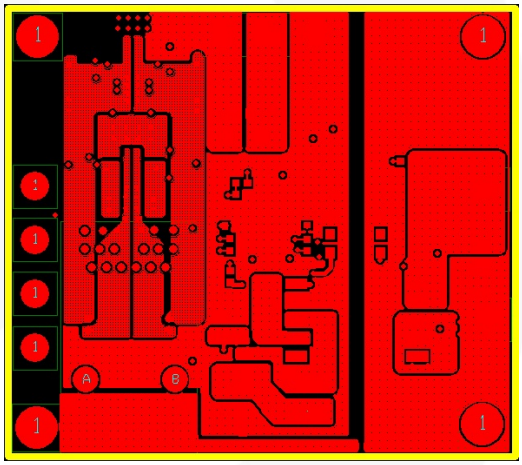

Figure 6. BOT & SMB Layer

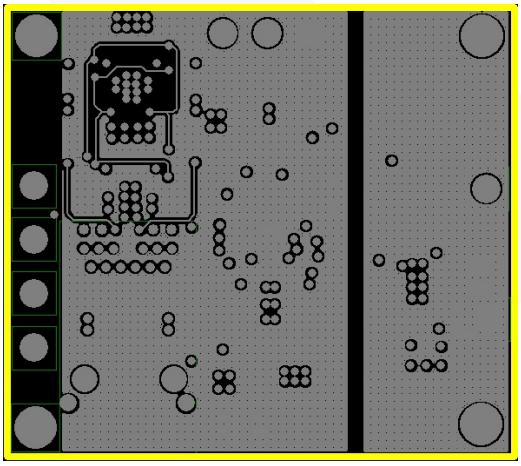

Figure 7. INNER1 (GND) Layer

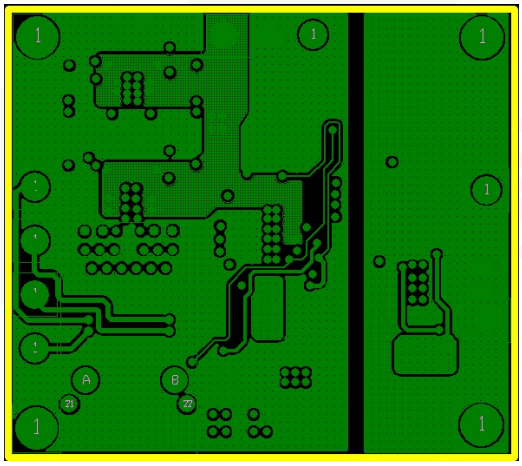

Figure 8. INNER2 (POWER) Layer

5. Schematic

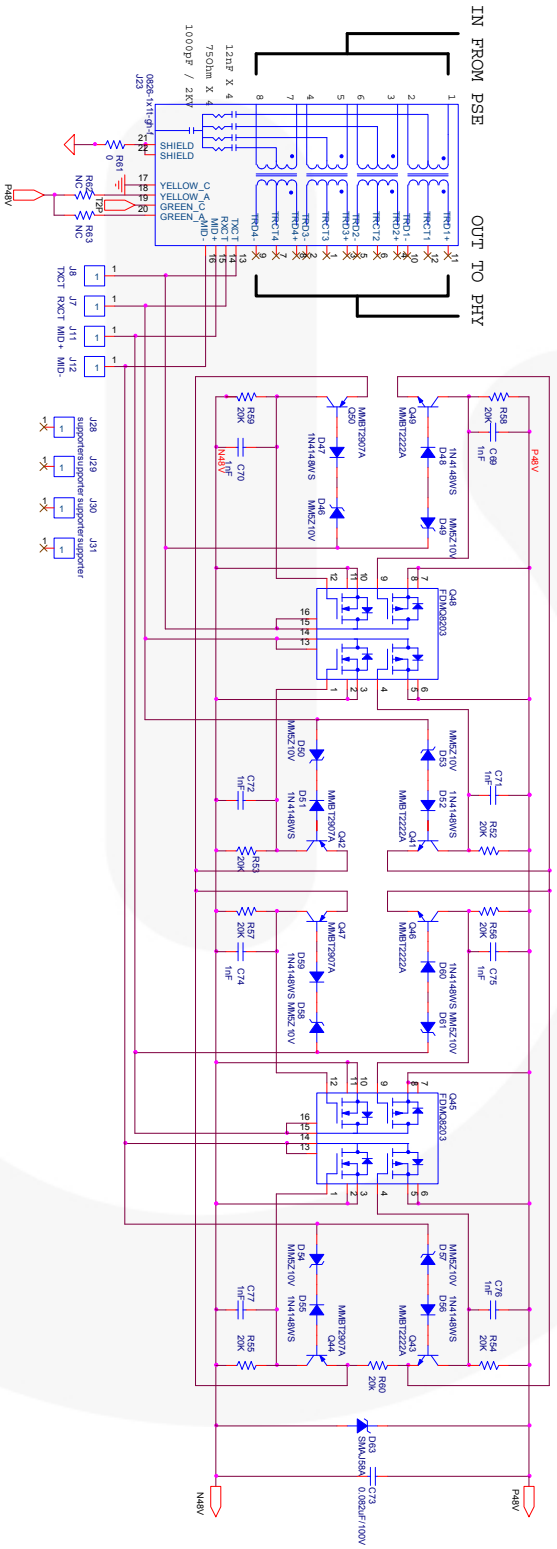

Figure 9. GreenBridge™ Block Schematic

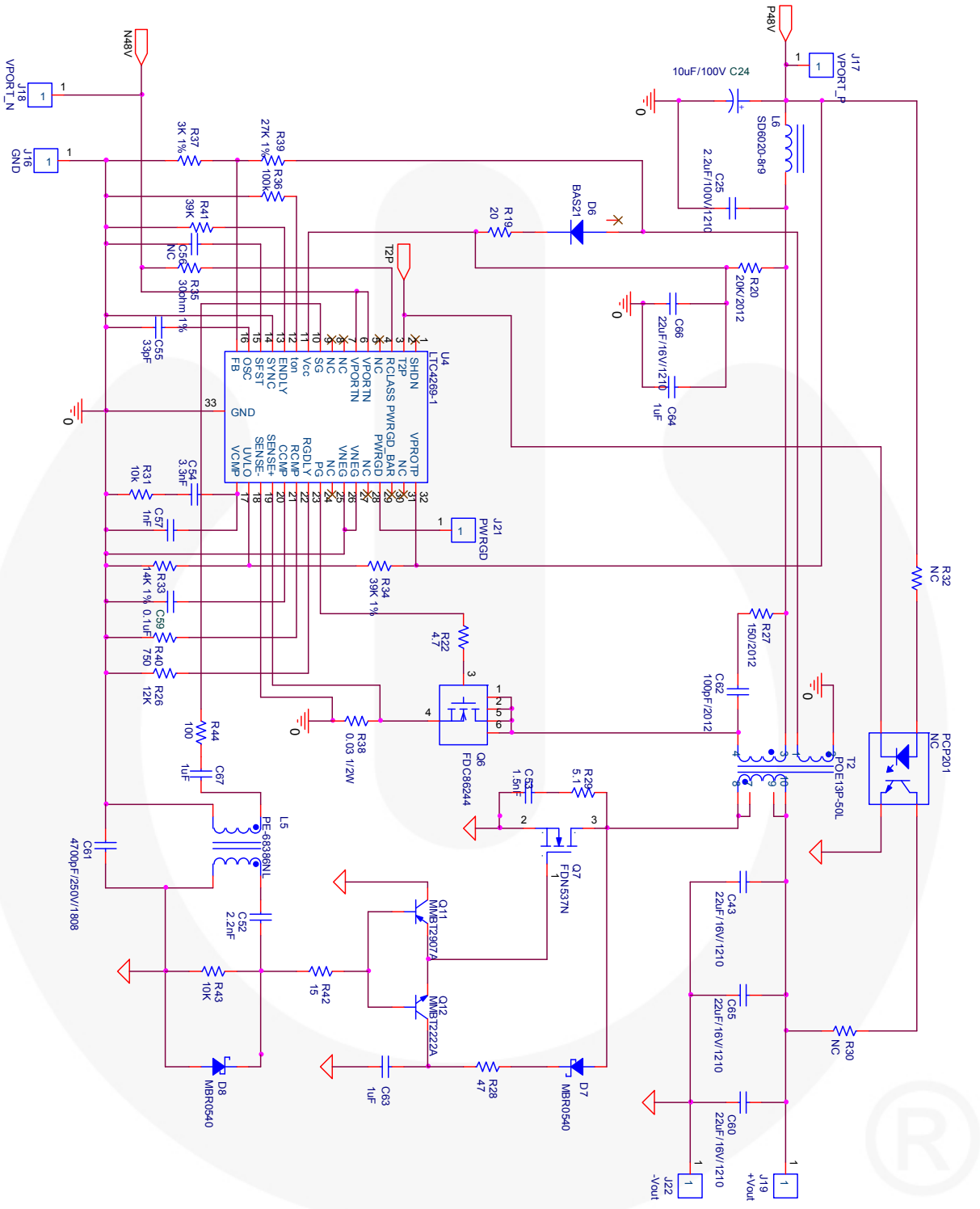

Figure 10. PoE Power Device Controller and Flyback DC-DC Block Schematic

6. Bill of Materials

Table 2. Bill of Materials

Item	Qty.	Reference	Part Name	Vender	Comment
1	1	C24	EEE2AA100UP	Panasonic	10 µF / 100 V
2	1	C25	GRM32ER72A225KA35	Murata	2.2 µF / 100 V
3	4	C43, C60, C65, C66	C3225X7RIC226M	TDK	22 µF / 16 V / 3216
4	1	C52	2.2 nF / 1608	Any	
5	1	C53	1.5 nF / 1608	Any	
6	1	C54	3.3 nF / 1608	Any	
7	1	C55	33 pF / 1608	Any	
8	6	R30, R32, C56, R62, R63, PCP201	NC		
9	9	C57, C69, C70, C71, C72, C74, C75, C76, C77	1 nF / 1608	Any	
10	1	C59	0.1 µF / 1608	Any	
11	1	C61	GA343D	Murata	4700 pF / 250 V
12	1	C62	100 pF / 2012	Any	
13	3	C63, C64, C67	1 µF / 1608	Any	
14	1	C73	C0805C823K1RACTU	Kemet	0.082 µF / 100 V
15	1	D6	BAS21	Fairchild Semiconductor	
16	2	D7, D8	MBR0540	Fairchild Semiconductor	
17	8	D46, D49, D50, D53, D54, D57, D58, D61	MM5Z10V	Fairchild Semiconductor	10 V Zener Diode
19	8	D47, D48, D51, D52, D55, D56, D59, D60	1N4148WS	Fairchild Semiconductor	
20	1	D63	SMAJ58A	Diodes	TVS Diode
21	1	J23	0826-1G1T-GH-F	Belfuse	RJ45 with Transformer
22	1	L5	PE-68386NL	Pulse trans	
23	1	L6	SD6020-8R9	Coiltronics	8.2 µH
24	1	Q6	FDC86244	Fairchild Semiconductor	150 V 144 mΩ MOSFET
25	1	Q7	FDN537N	Fairchild Semiconductor	30 V 28 mΩ MOSFET
26	5	Q11, Q42, Q44, Q47, Q50	MMBT2907A	Fairchild Semiconductor	
27	5	Q12, Q41, Q43, Q46, Q49	MMBT2222A	Fairchild Semiconductor	
28	2	Q45, Q48	FDMQ8203	Fairchild Semiconductor	GreenBridge™ Quad MOSFET
29	1	R19	20 Ω / 2012	Any	
30	1	R20	20 kΩ / 2012	Any	
31	1	R22	4.7 Ω / 1608	Any	
32	1	R26	12 kΩ / 1608	Any	
33	1	R27	150 Ω / 2012	Any	
34	1	R28	47 Ω / 1608	Any	
35	1	R29	5.1 Ω / 1608	Any	
36	2	R31, R43	10 kΩ / 1608	Any	

Bill of Materials (Continued)

Item	Qty.	Reference	Part Name	Vender	Comment
37	1	R33	14 kΩ 1% / 1608	Any	
38	1	R34	39 kΩ / 1% / 1608	Any	
39	1	R35	45.3 Ω / 1608	Any	
40	1	R36	100 kΩ / 1608	Any	
41	1	R37	3 kΩ / 1% / 1608	Any	
42	1	R38	0.03 mΩ / 0.5 W	HMR	Shunt Resistor
43	1	R39	24 kΩ / 1% / 1608	Any	
44	1	R40	750 Ω / 1608	Any	
45	1	R41	39 kΩ / 1608	Any	
46	1	R42	15 Ω / 1608	Any	
47	1	R44	100 Ω / 1608	Any	
48	9	R52, R53, R54, R55, R56, R57, R58, R59, R60	20 kΩ / 1608	Any	
49	1	R61	0 Ω / 1608	Any	
50	1	T2	POE13P-50L	Coilcraft	13 W PoE Transformer
51	1	U4	LTC4269-1	LTC	PoE Flyback IC

7. Electrical Characteristics

Table 3. Electrical Specification

Parameter	Value	Remark
GreenBridge™	FDMQ8203	Quad P&N-Channel MOSFET, Fairchild Semiconductor
Flyback Primary Switch	FDC86244	Single N-Channel MOSFET, Fairchild Semiconductor
Flyback Secondary Switch	FDN537N	Single N-Channel MOSFET, Fairchild Semiconductor
Controller	IEEE802.3at PD with Flyback Controller	
V_{OUT} Range	5 V	Adjustable by R39 and R37
Switching Frequency	250 kHz	Adjustable by C55
Maximum I_{OUT}	2.6 A	Limited by Power Component

8. Setup and Test Procedure

Table 4. Test Point Descriptions

Test Point	Label	Descriptions
J17	P48 V	Measurement test point for rectified positive input voltage
J18	N48 V	Measurement test point for rectified negative input voltage
J16	GND	Measurement test point for input voltage return
J19	+VOUT	Measurement test point for output voltage
J22	-VOUT	Measurement test point for output voltage return

8.1. Hardware Connector Description

The evaluation kit is fully assembled and tested. Follow the steps below to verify board operation.

1. Use one of the following methods to power the evaluation kit:

- If network connectivity is required: Connect a CAT5 Ethernet network cable from the evaluation kit input port RJ45 connector to the corresponding PSE Ethernet LAN connection, which provides power to the evaluation kit. J21 connector provides an interface with the Ethernet data signals only.
- If network connectivity is not required: Connect a -48 V DC power supply between the TXCT and RXCT. OR connect a -48 V DC power supply between the MID+ and MID-.

Caution: Do not turn on the power supply until all connections are completed.

2. Activate the PSE power supply or turn on the external DC power supply.
3. Using a voltmeter, verify that the evaluation kit provides +5 V across the +VOUT and –VOUT pins. –VOUT is isolated from the evaluation kit's input N48 V and GND pins.

9. Performance of Evaluation Board

Figure 11 and Figure 12 show measured data.

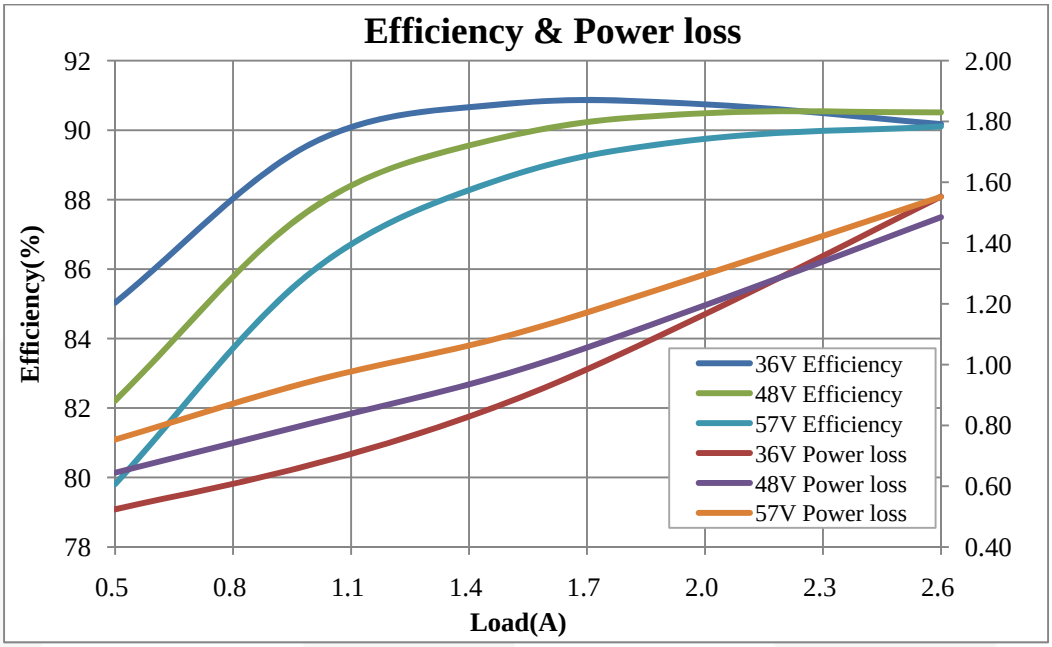

Figure 11. Efficiency & Power Loss at V_{OUT}=5 V, Soaking=5 Minutes, f_{SW}=250 kHz

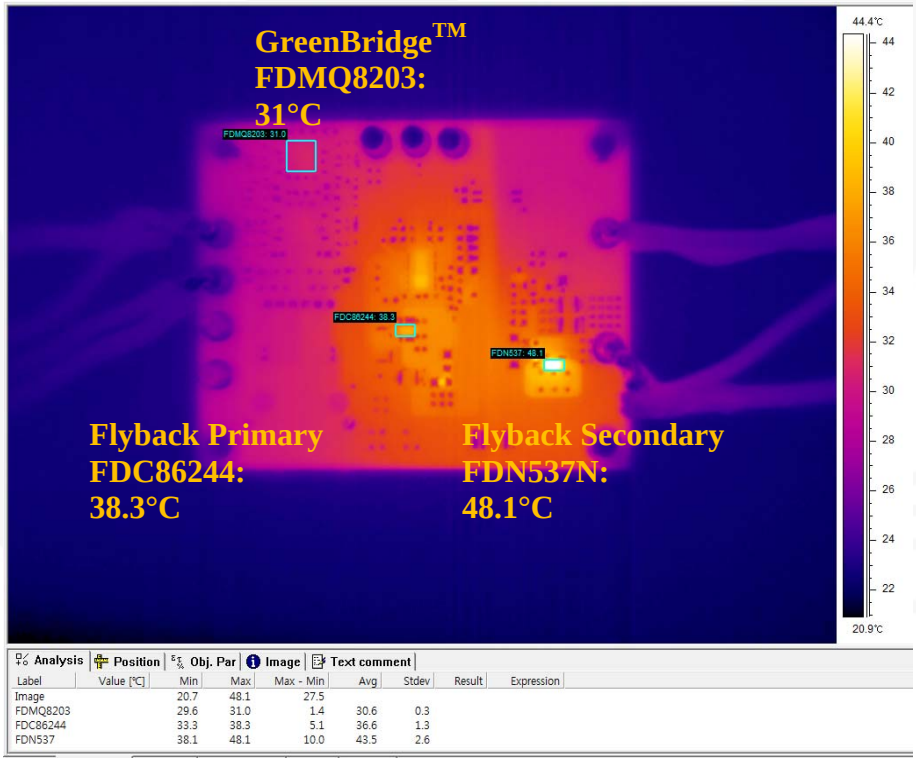

Figure 12. Thermal Performance at V_{IN}=48 V, V_{OUT}=5 V, I_{OUT}= 2.6 A, Soaking=5 Minutes, f_{SW}=250 kHz

10. Revision History

Rev.	Date	Description
0.1.0	February 13, 2012	Initial Release
1.0.0	November 28, 2012	Reformat to template Proofread and correct content

WARNING AND DISCLAIMER

Replace components on the Evaluation Board only with those parts shown on the parts list (or Bill of Materials) in the Users' Guide. Contact an authorized Fairchild representative with any questions.

This board is intended to be used by certified professionals, in a lab environment, following proper safety procedures. Use at your own risk. The Evaluation board (or kit) is for demonstration purposes only and neither the Board nor this User's Guide constitute a sales contract or create any kind of warranty, whether express or implied, as to the applications or products involved. Fairchild warrantees that its products meet Fairchild's published specifications, but does not guarantee that its products work in any specific application. Fairchild reserves the right to make changes without notice to any products described herein to improve reliability, function, or design. Either the applicable sales contract signed by Fairchild and Buyer or, if no contract exists, Fairchild's standard Terms and Conditions on the back of Fairchild invoices, govern the terms of sale of the products described herein.

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

EXPORT COMPLIANCE STATEMENT

These commodities, technology, or software were exported from the United States in accordance with the Export Administration Regulations for the ultimate destination listed on the commercial invoice. Diversion contrary to U.S. law is prohibited.

U.S. origin products and products made with U.S. origin technology are subject to U.S Re-export laws. In the event of re-export, the user will be responsible to ensure the appropriate U.S. export regulations are followed.